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Applicant: François GIRAULT  
Title: FOLDING RECTANGULAR PARALLELEPIPED  
BOX  
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**TRANSMITTAL OF SUBSTITUTE SPECIFICATION**

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Dear Sir:

Applicant has enclosed a Substitute Specification attached to a red ink marked-up copy of the verified English language translation of PCT International Application PCT/FR2005/000167. The red ink identifies changes to the verified English language translation which are incorporated in the Substitute Specification.

The Substitute Specification includes general revisions to correct idiomatic translational errors and to provide proper headings. The undersigned states that the Substitute Specification contains no new matter.

Based Upon: PCT/FR2005/000167

Applicant sincerely believes that this patent application is now in  
condition for prosecution before the U.S. Patent and Trademark Office.

Respectfully submitted,



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**FOLDING RECTANGULAR PARALLELEPIPED BOX**

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## **BACKGROUND OF THE INVENTION**

### **Field of the Invention**

This invention relates to a folding rectangular parallelepiped box which opens at the top.

### **Discussion of Related Art**

5                Boxes of this type are known, made entirely of plastic, comprising a base wall and a rectangular upper frame, together with four side walls, including two facing walls, called first walls, articulated to the frame while the other two facing walls, called second walls, including two leaves articulated to one another about an axis parallel to the base and also articulated both to the base and to the  
10               frame in such a way that after pivoting the first walls inwards to bring them into a plane parallel with the base, the two leaves of the second walls can be pivoted about the axis to bring them into a position in which they are folded one on the other towards the inside of the box in a position substantially parallel to the base.

                 It takes very little time to go from the erect position to the collapsed  
15               position, making this box particularly practical. Moreover, the fact that it is made entirely of washable plastic make it suitable for many varied uses.

However, as the base, the frame, the first walls and the leaves of the second walls constitute a number of independent parts articulated to one another, the manufacture and assembly of such boxes are relatively tedious.

5 Moreover, owing to its “all plastic” structure, the axes of articulation which consist of hinges or simple tabs may eventually break off the box if the load placed on them is too great.

U.S. Patent 2 755 955 also discloses a box of this kind.

10 A reinforcing plate with dimensions substantially equal to those of the second walls is associated with the top leaf of the walls, in such a way that, when the box is in the erect position, this plate presses against the associated second wall, while in the folded position the lower part of this plate is detached from the second wall and forms an inverted “Y” therewith.

This technical solution partially solves the problem of robustness of the box.

15 However, this box, like the box described previously, comprises a number of independent parts articulated to one another.

Moreover, such a box is also excessively heavy, giving rise to ergonomic problems.

Lastly, documents EP-A-1 302 405, JP-A-2000/072 141 and JP 2003/300 526 disclose box structures similar to that described above, whose base and two facing faces are obtained by folding a single sheet of plastic. These structures partially solve the weight problem. However, such boxes have a major drawback relating to their lack of rigidity.

### SUMMARY OF THE INVENTION

One object of this invention is to overcome these drawbacks by proposing a box whose structure is rationalized, in such a way as to reduce its number of parts while ensuring good robustness and excellent rigidity.

Another object of this invention is to provide a lightweight box whose internal walls do not have surface irregularities that could damage the goods transported.

The invention relates to a folding rectangular parallelepiped box which opens at the top, comprising a base wall and a rectangular upper frame, together with four side walls, including two facing walls, called the first walls, being articulated to the base or frame while the other two facing walls, called the second walls, include two leaves one of which is articulated to an axis parallel to the base, are also articulated both to the base and to the frame in such a way that after pivoting the first walls inwards to bring them into a plane parallel with the base, the two leaves of the second walls can be pivoted about the axis to bring

them into a position in which they are folded one on the other towards the inside of the box in a position substantially parallel to the base. The base and the second walls comprise a single folded sheet of plastic or cardboard, while the axes of articulation of the walls to the base and to the frame, and of the leaves to one another, comprise fold lines.

In accordance with one preferred embodiment the upper leaf of the second walls is extended by a reinforcing plate with dimensions substantially identical to those of the walls. This plate surrounds the frame and is secured to the inner face of the upper leaf, in such a way that when the box is in the erect position, this plate presses against the associated second wall, while in the folded position the lower part of this plate is detached from the second wall and forms an inverted "Y" therewith.

By virtue of this feature, a single sheet is used to form the upper leaf of the second walls and the reinforcing plate, instead of parts which, in the prior art, consisted of different elements.

This has an advantageous effect on the method for manufacturing the box and its cost price.

Furthermore, because the axes of articulation comprise fold lines, problems of articulation hinges or tabs breaking or coming off, or constituting

reliefs and surface irregularities that could damage the goods transported are minimized or avoided.

Moreover, according to other advantageous and non-limiting features:

5           the plastic comprises cellular polypropylene, in particular extruded, or solid polypropylene;

          the frame comprises a cylindrical metal wire, for example made of steel;

          an additional reinforcing element is inserted between the upper leaf of the second walls and the reinforcing plate;

10          the reinforcing plate is itself extended by a flap which is folded at least once on itself, against the reinforcing plate, in such a way as to form an additional reinforcing element inserted between the upper leaf of the second walls and the reinforcing plate;

          the first walls are articulated to the frame and are extended by a reinforcing plate which surrounds the frame and is secured to their inner face;

15          an additional reinforcing element is inserted between the first walls and their reinforcing plate;

          the first walls and/or the second walls comprise a recess forming a handle;

20          the recess is positioned at the top of the first walls and exposes a part of the frame, in such a way that it constitutes a gripping handle;

the base is secured to a reinforcing plate;

the corners of the base bear, directly or via the reinforcing plate, on “foot” cups;

the corners of the upper rectangular frame have “stacking” cups positioned in such a way that when two identical boxes are stacked, the foot cups of the upper box bear on the top of the stacking cups of the lower box;

along two of its opposite edges, the plate comprises a stop for the first walls in the vertical position;

the inward-facing face of the walls is smooth.

Further features and advantages of the present invention will be evident on reading the following detailed description, provided with reference to the attached drawings.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figures 1 to 3 are perspective views of a box according to one embodiment of the invention, in the erect, semi-folded and folded positions, respectively.

Figure 4 is a simplified front view of the box, its first walls not being shown, intended to illustrate how it is folded/unfolded.

Figure 5 is an end view of a first wall.

Figure 6 is an end view of a variant of the first wall of Figure 5.

Figure 7 is a side view of part of the sheet constituting the base and the second walls of the box, according to another embodiment.

Figure 8 is an end view of a second wall according to Figure 6, modified to receive a gripping handle.

5                   Figure 9 is a partial front view of such a wall, after a sunken handle has been fitted.

Figure 10 is also a partial front view of a first wall, in which a sunken support has been fitted for an information label.

10                   Figures 11 to 13 are perspective views, in the erect, semi-folded and folded positions, respectively, of another embodiment of the box, the corners of the base having “foot cups” while the corners of the upper frame have complementary “stacking cups”.

Figures 14 and 15 are perspective detail views of the foot cups and stacking cups of two superposed boxes, in the folded position.

15                   Figures 16 and 17 are sectional views, in a vertical, longitudinal plane, of a foot cup with and without the box base and its reinforcing plate, respectively.

Figure 18 is a perspective view of a reinforcing plate of the box base, associated with a metal reinforcing element.

Figure 19 is a schematic view, along a vertical, transverse sectional plane, of a box having a base reinforcing element in accordance with Figure 18.

Figure 20 is perspective view of another reinforcing plate of the box base, with thermoformed stiffening studs.

5                    Figure 21 is a schematic view, along a vertical, transverse sectional plane, of a box having a base reinforcing element in accordance with Figure 20.

Figure 22 is a perspective view of another embodiment of the plate of figure 20.

10                   Figures 23 and 24 are sectional views, in transverse and longitudinal planes, respectively, of a box incorporating the plate of Figure 22.

### **DESCRIPTION OF PREFERRED EMBODIMENTS**

The box 1 shown in the attached figures is a folding rectangular parallelepiped box which opens via the top.

15                   The box 1 includes an upper rectangular frame 2, a base 3, and four side walls, namely two first facing walls 5 and two second facing walls 4.

In the embodiment shown here, the frame 2 is made of a cylindrical steel wire. In a variant not shown, it could comprise for example a rigid molded plastic, or bent steel tubes.

The frame 2 has two first sides 20, which form the small sides of the rectangle in which it is inscribed, and two second sides 21, which form the large sides of the rectangle.

5       Note that the first sides 20 extend to a height slightly greater than that of the second sides 21.

The latter are joined to the first sides 20 at corner regions of the frame 2, as shown in particular in Figure 1.

10       At these corners, the first sides 20 are extended, at their opposite ends, by two small wings 22 which extend horizontally at a right angle, overhanging the second sides 21.

Also in these corners, the frame 2 has a metal wire 23 attached to the ends of the first sides 20 and to the end of their wings 22, to form a lateral stop element whose purpose will be explained later.

The first walls 5 of the box 1 are articulated to the frame 2.

15       More specifically, these walls 5, the base 3 and the second walls 4 are made of a rigid material, plastic or cardboard.

In the illustrated embodiment they are made of extruded cellular polypropylene.

By this is meant a sheet of polyethylene comprising two parallel walls joined together by parallel partitions, which lie in planes perpendicular to those of the walls.

5 In the illustrated embodiment, and visible more particularly in Figure 5, each first wall 5 is extended by a reinforcing plate 50 of identical dimensions.

In this case it is a single sheet  $F_1$  folded twice along two fold lines  $L_1$  and  $L_2$  parallel to two of their opposite sides. The sheet is folded around the corresponding side 21 of the frame 2, in such a way that it surrounds it and the  
10 wall 5 and the plate 50 are parallel and face one another.

Between them is inserted an additional reinforcing element 8, also in the form of a plate, which, for example, is adhesively bonded to the wall 5 and to the plate 50 on their facing faces.

This reinforcing element has, as shown in Figure 5, a thickness  
15 corresponding approximately to the diameter of the wire constituting the frame 2.

It is preferably made of the same material as used for the walls 5, i.e., in the present case, cellular polypropylene.

Purely by way of example, the walls 5 are about four millimeters thick, while the reinforcing element 8 is about 8 millimeters thick. The assembly  
20 thus formed is therefore about 16 millimeters thick.

The element 8 is not only intended to reinforce the wall 5 but also to keep the wall 5 and the plate 50 parallel.

The side 20 of the frame 2 thus forms an axis of articulation for this assembly.

5 For convenience, the term “wall 5” will be used to designate both the wall itself and the assembly it forms with the plate 50 and the reinforcing element 8.

10 In the upper part of the two walls 5, half way between the corners of the frame 2, are rectangular recesses 51 which expose a corresponding portion of the wire constituting the side 20 of the frame 2. Their purpose will be explained later.

According to one embodiment of the invention, the base 3 and the second walls 4 of the box 1 comprise a single folded sheet  $F_2$  of plastic or cardboard.

15 Preferably, but not obligatorily, the same material is used as for the sheet  $F_1$ .

More specifically, and as shown in Figure 4, the base 3 is extended along two of its opposite sides by the second walls 4 which are themselves formed of a lower leaf 40 and an upper leaf 41.

Two first fold lines, parallel and close to one another  $L_3$  and  $L_4$ , separate the base 3 from the lower leaf 40.

The latter is separated from the upper leaf 41 by an additional fold line  $L_5$  parallel to the above two lines.

5                    In the illustrated embodiment, each second wall 4 is extended by a reinforcing plate 42 of dimensions identical to this second wall.

More specifically, it is still the same sheet  $F_2$  folded two more times along two fold lines  $L_6$  and  $L_7$ , parallel to the above lines.

10                   This portion of the sheet  $F_2$  is folded around the corresponding side 21 of the frame 2 in such a way that the wall 5 and the plate 42 are parallel to one another, facing one another, when the box 1 is in the erect position of Figure 1.

15                   Thus, as is visible in Figure 4, an additional reinforcing element 8, also in the form of a plate, is inserted here, this element being for example adhesively bonded to the upper leaf 41 of the wall 4 and to the plate 42, on their facing faces.

As in the case of the reinforcing element of the first walls 5, this element 8 has a thickness corresponding approximately to the diameter of the wire constituting the frame 2.

It is preferably made of the same material as used for the walls 4.

This reinforcing element has dimensions identical to those of the plate 42.

When the box 1 is in the erect position, as shown in particular in Figure 1, the element 8 presses against the associated wall 4, in the vertical position.

By contrast, in the semi-folded position, as shown in Figure 2, the lower part of the element 8 and the associated lower part 420 of the plate 42 detach from the leaf 40, the whole thus formed constituting a sort of inverted "Y".

Preferably, and as shown in Figure 4, the base 3 receives a reinforcing plate 9, for example adhesively bonded and preferably made of the same material as the rest of the box. It may however be made of a different material.

Figures 1 to 3 show stops 6, attached to two opposite sides of the base 3, whose purpose is to immobilize the walls 5 in the vertical position.

To go from the erect position of Figure 1 to the folded position of Figure 3, first pressure is exerted on the outer face of the walls 5 so that they pivot upwards about the sides 20 of the frame 2, in the direction of the arrows f.

Once the first walls 5 are in the horizontal position, as shown in Figure 2, pressure is exerted on the outer face of one and/or other of the leaves 40 and 41 of the walls 4.

Thus, the lower part of the element 8 detaches from the associated wall, greatly facilitating its folding along the line  $L_5$ . This movement is symbolized by the arrows  $g$  in Figure 1.

By then pressing downwards on the frame 2, the walls 4 are forced to fold completely so as to obtain the position of Figure 3.

Note that the height of the walls 4 and 5 can be determined in such a way that, when the box is erected, their lower edge comes into contact with the base with a great degree of friction, so that the maneuvers described above can only be performed by applying considerable pressure. In accordance with a preferred embodiment, this overcomes the drawback of accidental folding of the box, as happens with certain boxes in the prior art.

In an embodiment not shown in the figures, the first walls 5 are articulated not to the frame 2 but to the base 3.

As explained above, rectangular recesses 51 are made in the upper part of the two walls 5, half way between the corners of the frame 2. The recesses 51 expose a corresponding portion of the tube constituting the side 21 of the frame 2. As long as these recesses 51 are dimensioned appropriately, they free enough space for an operator to insert his hands, such that the exposed parts thus serve as gripping handles.

The above-described box is suitable for stacking, both when erect and when folded. In this case, the upper box bears on the lower box at the corners of the frame 2, in the region where the sides 21 are extended by the wings 22. However, lateral movement of the upper box, i.e., in a direction parallel to its base 3, is prevented by the wire 23 which acts as a stop.

Because a single sheet  $F_2$  is used for elements which, in the prior art, consisted of five different parts, the box is much easier to manufacture. There are also savings in terms of materials.

In addition, since the axes of articulation comprise fold lines which prove very wear resistant, problems with articulation hinges or tabs breaking or detaching, as with the boxes of the prior art are minimized or avoided.

At least the inward-facing wall of the sheets  $F_1$  and  $F_2$  are smooth, i.e., without surface irregularities. This is particularly important when transporting fragile or easily damaged parts. Indeed, without surface irregularities, such parts can be packaged and transported in a box according to the invention without risk of damage.

Figure 6 shows an embodiment of a first wall 5. In this case there is also just a single sheet  $F_1$  surrounding an additional reinforcement element 8 (for example made of cellular polypropylene, CPP for short). The sheet  $F_1$  thus forms both the first wall 5 and the reinforcing plate 50. However, unlike the

embodiment of the previous figure, the opposite ends 500 of the sheet  $F_1$  meet midway up the height of the plate 50, on the side away from the wall 5.

Since this wall is designed to be turned outwards, its surface is smooth, with no discontinuities. Moreover, the upper and lower edges of the wall are closed, with no sharp angles, making them less “aggressive” in the sense that this reduces the risk of catching and premature wear by friction.

The embodiment of the second wall 4, as shown in Figure 7, is based on the same concept. As in the previous embodiments, the reinforcing plate 42 of the second wall 4 is itself extended by a flap which in this case comprises two leaves 43 and 44 folded on themselves ( $180^\circ$ ) against the plate 42. They are fixed thereto for example.

This makes it possible to do without an additional reinforcing element separate from the reinforcing plate. Again, the upper and lower free edges of the wall 4 and its associated reinforcing plate 42 are closed and have no sharp angles, making them less aggressive.

Furthermore, the additional stiffness provided by the element 8 is in this embodiment advantageously replaced by the “multiplication” of flaps.

As shown in Figures 8 and 9, openings 410 in the form of a “window” may be made in the walls 4, extending from the upper leaves 41 of the

walls 4 to the leaves 43 and 44, inclusive. In other words, these openings have an end wall closure formed by the plate 42.

These windows are designed to receive sunken handles 411 such as made of injection-molded plastic.

5 Naturally, care will have been taken beforehand to make the openings in such a way that they are positioned facing one another in pairs in each wall 4.

The presence of an end wall closure formed by the plate 42 has the advantage of preventing dust from getting into the boxes in this region when they  
10 are stacked in the erect position.

Likewise, and as shown in Figure 10, the walls 5 may also have an opening 51 in which a label holder 52 is fitted. An accessible access space 53 is provided so that an interchangeable label can be placed in it. As appropriate, seals of adhesive may be deposited around the periphery of the label holder 52, to better  
15 ensure that water running down the walls 5 does not enter through them.

Figures 11 to 13 show an embodiment of a box whose base corners bear, directly or indirectly on “foot” cups 30.

The corners of the upper frame 2 also have “stacking” cups 24. They are positioned in such a way that when two identical boxes are stacked, the

foot cups 30 of the upper box bear on the top of the stacking cups 24 of the lower box.

Their structure will be described with more particular reference to Figures 14 to 17.

5                   The foot cups 30 are molded plastic parts which are rigid but elastically deformable.

The foot cups 30 have an outer shape in the form of an “L” delimited by two vertical low walls 300 at right angles. In the corner where the two low walls 300 meet, a finger 301 extends also vertically, projecting upwards.

10                   The bottom of the two low walls 300 is extended inwardly by a first horizontal shelf 302, a vertical partition 303 and a second shelf 304. It thus has a stair-like profile.

One of the low walls 300 has a lip 306 extending horizontally inwards, at one of its ends. The purpose of the lip will be explained later.

15                   Lastly, a molded finger 305 projects upwards from the “internal” shelf 304. Its height is such that it rises slightly above the lip 306.

The first shelf 302 is designed to receive the base 3 of the box, while the shelf 304 receives a thick reinforcing plate 9, for example made of CPP.

Naturally, the plate 9 is put in place first. If necessary, metal stiffening elements 91 are inserted in the cells of its smaller opposite edges. They comprise curved bars whose body 910 has three prongs 911 and 912 which are inserted in the abovementioned cells. The prong 911 is in the middle, while the prongs 912 are located at the ends.

Before it is put in place, the plate 9 is drilled with holes 90, whose positions correspond to those of the fingers 305.

The plate thus rests on each of the shelves 304. Its thickness is substantially equal to the depth of the partition 303.

The base 3 bears on the shelf 302, lying above the plate 9.

It is slightly less thick than the gap between the shelf 302 and the lower face of the lip 306.

The lip 306 constitutes a means for immobilizing the base 3 vertically.

Like the plate 9, the base 3 has holes 31 for the fingers 305 to pass through.

Once the base 3 has been put in place, snap-fastenable caps 305' are fitted over the top of the fingers 305 to complete the assembly and prevent the base 3 and the plate 9 from coming detached accidentally.

The “stacking” cups 24 are in the form of thick L-shaped corner pieces. They are also made of molded plastic. Their upper edge is referenced 242 while their right-angled wings are referenced 240.

5 The wings 240 have a groove 241 running vertically over most of their height and opening out on their lower edge.

These cups are force-fitted over the raised corners of the metal frame 2 of the box. To do so, the opposite vertical faces of the groove 241 are spaced in such a way that they clamp the metal of the frame.

10 The thickness of these cups is such that when two boxes are superposed, the lower face of the shelf 302 of the upper box bears on the upper edge 242 of the stacking cups 24 of the lower box.

Because it is a case of two flat, horizontal surfaces bearing one on the other, the stack thus created is particularly stable.

15 Note that in the corner region where their two wings 240 meet, the cups 24 have a downward-facing recess 243 whose shape is complimentary to the shape of the top of the fingers 301 of the foot cups 30.

When the box according to this embodiment is in the folded position (Figure 13 and top of Figure 14), the finger 301 of each foot cup 30 snap-fastens into the recess 243 of each stacking cup 24.

20 This ensures that the box is held firmly in the folded position.

To unfold the box, all that is required is to pull upwards on the box 2 to disengage the fingers 301 from the openings 243.

Figure 19 shows, very schematically, a box made in this way.

5 The thickness of the plate 9 is designated  $e$ , its width is  $l_1$  and the width of the base 3 is  $l$ ,  $l_1$  being smaller than  $l$ .

Figure 20 shows an alternative embodiment of the plate 9 which in this case bears the reference 9'.

It is a plastic plate with thermoformed studs 90' making it very rigid.

10 This plate has a flat rim 91' which bears on the cups 30.

Figure 21 shows, schematically, a box thus equipped.

The embodiment of Figure 22 also shows such a plate 9', its rim 91' being extended upwards by a peripheral surround 92'-93' of height  $h$ .

15 As shown in Figure 23, the sheet placed on such a plate 9' has a base 3 which is separated from the walls 4 by a peripheral surround 4' of the same height as the surround 93'.

The overall length of the plate 9' is referenced  $L$ , while  $L_1$  designates the "working" length covered by the studs 90'.

Parallelepiped studs 94', of substantially the same height as the surround, are provided on the small faces 93' of the surround, which have a width l.

As shown in Figure 24, the top of these studs 94', forming "stop surfaces", is designed to serve as a support for the bottom of the walls 5 of the box in the erect position. The load is therefore borne by the top of these studs.

By way of example, the boxes just described have the following dimensions:

height in erect position: 250 millimeters;

height in folded position: 60 millimeters;

length: 800 millimeters;

width: 600 millimeters.

Such boxes are particularly suitable for transporting articles such as heavy or fragile motor vehicle parts which must be transported between several remote production sites.

They can support a load of around 30 kg, for an empty weight of around 3 to 4 kg.